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Millipedes (Diplopoda) from the Zemplén Mountains, Northeast Hungary, with two julid species new to the Hungarian fauna

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Abstract. New data of millipedes from 92 sites in Northeastern Hungary are presented, based on the examination of more than 1300 individuals. The studied regions were the Zemplén Mountains and its surrounding plains, the Hernád valley and the Bodrogköz area. Altogether 25 millipede species were found, two Carpathian species are new to the fauna of Hungary: *Leptoiulus liptauensis* (Verhoeff, 1899) and *Cylindroiulus burzenlandicus* (Verhoeff, 1907). Remarkable and rare species for the Hungarian fauna are *Trachysphaera costata* (Waga, 1858) and *Brachydesmus dadayi* Verhoeff, 1895.

Keywords. Diplopoda, fauna, Transdanubian Mountains, Hernád Valley, Bodrogköz.

INTRODUCTION

Faunistic knowledge of the Hungarian millipedes (Diplopoda) is still incomplete and novelties can turn up, despite the surveys in the past decades (see e.g. Korsós 2005). Exact distributional records of millipedes are only known from 21.2% of the country area (based on the UTM mapping system of Hungary (Korsós 2005)). Especially the eastern and northeastern parts of the country are represented by only a few data (e.g. Korsós 1994, 1998). This study presents new faunistic records from the almost entirely unknown region of Northeast Hungary: the Zemplén Mountains, ("Zempléni-hegység") and its surrounding plains, the Hernád valley ("Hernád-völgy") and the Bodrogköz area (Fig. 1).

The Zemplén Mountains are volcanic parts of the Hungarian Northern Middle Range. The highest peak of the mountains is the Nagy-Milic (895 m a.s.l.). Dominant base rock types are andesite, rhyolite and tuff, and the soil is mainly acidic (Kiss 2007). Vegetation of the Zemplén Mountains is usually considered intermediate between the plant associations of the Hungarian Middle Ranges and that of the Carpathians, with presence both Pannonian and Carpathian floral elements. The lower parts of the Zemplén Mountains (up to 600 m a.s.l.) are dominated by forest-steppes (such as *Aceri tatarici–Quercetum roboris*) and various oak (*Quercetum*) forests, whereas the native forests in the higher parts (600–840 m a.s.l.) are oak-hornbeam (*Querco–Carpinetum*) and beech (*Fagetum*) forests (Simon 2006). Since 1984 a 26,500 ha area of the Zemplén Mountains has been designated for protection (as a landscape protection area, called "Zempléni Tájvédelmi Körzet"). The Zemplén Mountains are surrounded by lower sandy floodplains of the rivers Hernád and Bodrog. These are covered mainly by floodplain (*Populetum*, *Salicetum*, *Alnetum*) and oak forests (*Convallario–Quercetum roboris*) together with marshes, grasslands and agricultural fields (Tuba & Szirmai 2008).

Our goal was to survey the poorly known diplopod fauna of the area, and to improve our knowledge of the Hungarian millipedes.

MATERIALS AND METHODS

Millipedes were collected by the fourth author (GH) with pitfall trapping (with ethylene-glycol as preservative), singling and litter sifting, altogether in 91 sampling localities. Collecting period was between May 1999 and July 2006. An additional singling (Hejce, Sólyomkő) was made in July 2008 by the first author (DB), so the total number of sampling localities is 92. All materials collected were preserved in 70% ethanol and

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deposited in the Myriapoda Collection of the Hungarian Natural History Museum, Budapest. For identification we used a Nikon SM-800 and a Motic SMZ-168 stereo microscope, and the works by Bielak-Oleksy & Stojałowska (1968), Blower (1985), Schubart (1934) and Verhoeff (1895, 1899). Line drawings were made with Leica M125 stereo microscope and Leica DM-1000 light microscope.

Valid nomenclature was applied according to Fauna Europaea (Enghoff & Kime 2009, 2011). At each species we give a general synonymy list, with the important Hungarian citations of the species; the list of localities (settlement names separated by comma and followed by the local geographical names, all in Hungarian to facilitate localization on a regional map) and additional biogeographical or ecological remarks.

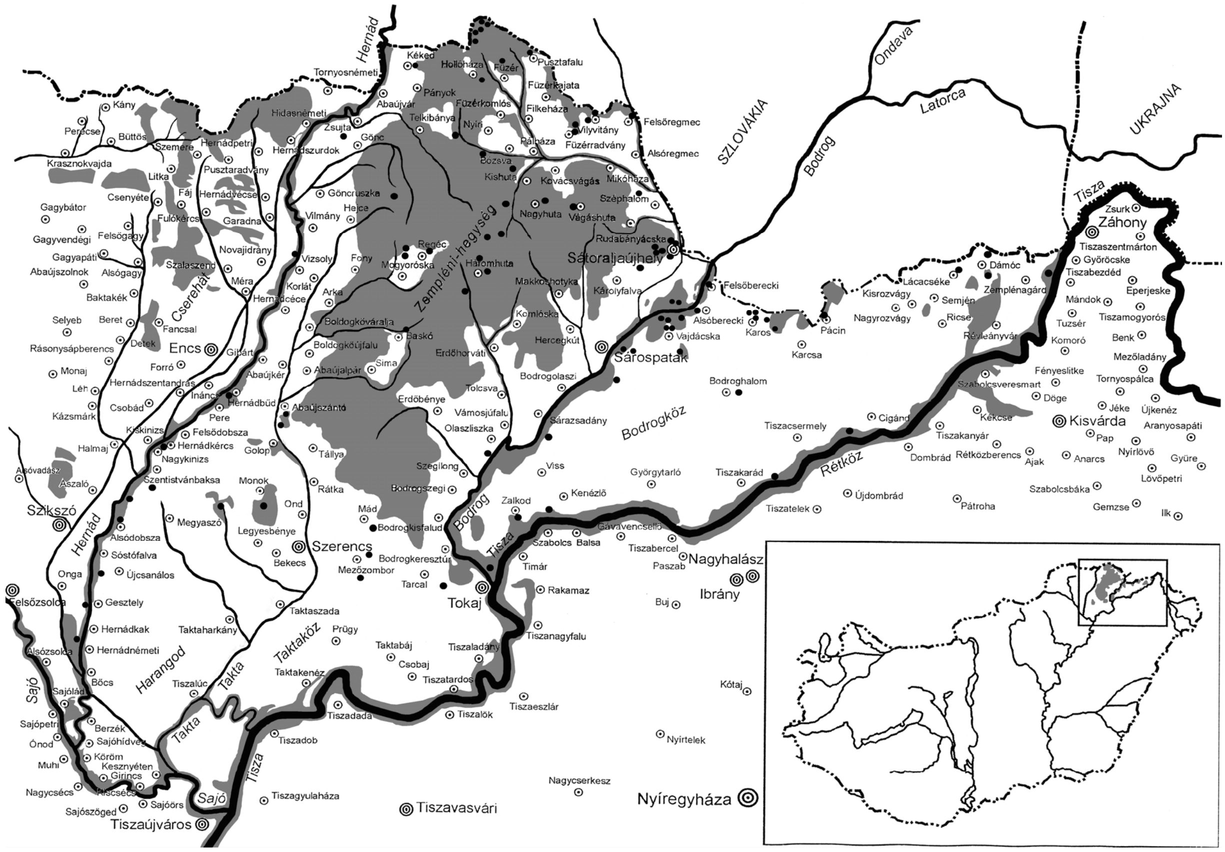


Figure 1. Map of the studied region: Zemplén Mountains, Hernád valley and Bodrogköz area. Black dots: collecting sites; white circles with small black dots: settlements in the area; dark grey area: forested area; light grey area: natural habitats except forests (grasslands, meadows, scrubland...etc.); white area: agricultural and urbanised areas.

RESULTS

POLYXENIDA

Polyxenidae

Polyxenus lagurus (Linnaeus, 1758)

Scolopendra lagura Linnaeus, 1758: 637.
Pollyxenus lagurus: Latreille 1802–1804: 45.
Polyxenus lagurus: Latzel 1884: 70, Loksa 1953: 178.

Localities. Háromhuta, Flórika-forrás; Háromhuta, Huta-völgyi kút; Pácin, Mágócsi-kastély.

Remarks. The species was found only in three, mostly native forest localities with nine specimens altogether. It is a holarctic species though easily overlooked (Enghoff & Kime 2011), relatively common also in Hungary (Korsós 1994). The scarce presence in the samples may be due to the collecting method by pitfall traps.

GLOMERIDA

Glomeridae

Glomeris hexasticha Brandt, 1833

Glomeris hexasticha Brandt, 1833: 197.
Glomeris hexasticha: Jermy 1942: 21–24, Loksa 1968a: 266–272.

Localities. Felsőregmec, Mátyásháza; Fony, Fekete-patak; Fony, Tekenős; Füzér, Drahos; Füzér, Halyagos-rét; Füzér, Kerékgyártó-bükk; Füzér, Torok; Füzér, Vár-forrás; Füzérradvány, Arborétum; Háromhuta, Flórika-forrás; Hejce, Sólyomkő; Hernádbűd, Gaz; Pusztafalu, Kertek alja; Regéc, Ördög-völgy; Regéc, Bálint-hegy; Sátoraljaújhely, Boda-dűlő; Sátoraljaújhely, Gejzír-domb, Sátoraljaújhely, Gyalmos; Sátoraljaújhely, Kecske-hát; Sátoraljaújhely, Májuskút, szőlő; Telkibánya, Kecske-hát; Vilyvitány, Magócsa-patak; Vilyvitány, Vilyi-legelő.

Remarks. An abundant species in the studied regions. It occurred together with *Glomeris tetrasticha* in 6 localities. The species is one of the most abundant species in Hungary and in Central and Southeast Europe as well, widespread mostly in natural woodlands (Korsós 1994, Enghoff & Kime 2011, Voigtländer 2011).

Glomeris tetrasticha Brandt, 1833

Glomeris tetrasticha Brandt, 1833
Glomeris connexa C. L. Koch, 1847: 97.
Glomeris connexa: Schubart 1934: 41–43, Jermy 1942: 37–42, Loksa 1953: 178.
Glomeris tetrasticha: Hoess 2000: 13, Hoess & Scholl 2001: 18, Lazányi & Korsós 2009: 36–37.

Localities. Baskó, Tekeres-patak; Bózsva, Farkas-völgy; Dámóc, Őrhegy; Füzér, Bodó-rét; Füzér, Halyagos-rét; Füzér, Kerékgyártó-bükk; Füzér, Oláh-rét; Füzér, Vár-forrás; Pusztafalu, Kertek alja; Sátoraljaújhely, Gyalmos; Sátoraljaújhely, Kacsa-tó; Sátoraljaújhely, Long-erdő (Háromhonvéd-fa); Telkibánya, Kecske-hát.

Remarks. The species occurred altogether in 13 localities, mainly in the forests of the mountainous Zemplén, but in some cases in the lower floodplains, too. It is a principally montane species, widespread in Eastern Europe (Korsós 1994, Enghoff & Kime 2011, Wytwer *et al.* 2009).

Dideriidae

Trachysphaera costata (Waga, 1857)

Gervasia costata Waga, 1858: 829.
Gervaisia costata: Jermy 1942: 54–59.
Trachysphaera schmidtii Heller, 1858: 317.
Trachysphaera hyrtlii Wankel, 1861: 253–254.
Trachysphaera costata: Strasser 1966: 334, Korsós 1994: 33.

Localities. Füzér, Vár-forrás.

Remarks. Three specimens (2 males, 1 female) were found in August 2005 near the castle ruins of Füzér (Northeast Zemplén) next to a spring located in a closed hornbeam forest (at about 480m a.s.l.). Previously the species was only reported from Budapest (Jermy 1942, Loksa 1959) and Szentdomonkos (Upponyi Hills, Northeast Hungary) (Korsós 1994).

POLYZONIIDA

Polyzoniidae

Polyzonium germanicum Brandt, 1837

Polyzonium germanicum Brandt, 1837: 179.
Polyzonium germanicum: Loksa 1968a: 266.

Localities. Dámóc, Őrhegy; Füzér, Torok; Karcsa, Becskedi-erdő; Pusztafalu, Kertek alja; Sátoraljaújhely, Gyalmos; Sátoraljaújhely, Long-erdő (Háromhonvéd-fa); Sátoraljaújhely, Mocsolya; Telkibánya, Kecske-hát.

Remarks. Thirty-eight specimens were found in 8 localities, almost all in oak-hornbeam forests of the Zemplén Mountains. The species was previously recorded from several other Hungarian localities, especially from old, undisturbed forests (Korsós 1994, Lazányi & Korsós 2009).

CHORDEUMATIDA

Mastigophorophyllidae

Mastigona bosniensis (Verhoeff, 1897)

Heteroporatia bosniense Verhoeff, 1897a: 193–195, Loksa 1968a: 272–276.
Mastigona bosniensis: Jeekel 1971: 67, Loksa 1988: 164.
Heteroporatia bosniense hungaricum Loksa, 1953: 179.

Localities. Abaújszántó, Kassi-szőlő; Kovácsvágás-Somoska; Pácin, Mágocsi-kastély; Sárospatak, Keleti-Bodrog-holtág; Sátoraljaújhely, Boda-dűlő; Sátoraljaújhely, Gyalmos; Sátoraljaújhely, Kecske-hát; Sátoraljaújhely, Long-erdő (Háromhonvéd-fa); Telkibánya, Kecske-hát.

Remarks. The species occurred in 9 localities in all of the three regions, but only with 22 specimens. These sites represent forests under different disturbance levels: oak-hornbeam forests, floodplain forests and in forest edges of former vineyards. The widespread species occurs in various habitats of Eastern Europe (e.g. Jędryczkowski 1992, Korsós 1994, Wytwer *et al.* 2009).

JULIDA

Nemasomatidae

Nemasoma varicorne C. L. Koch, 1847

Nemasoma varicorne C. L. Koch, 1847: 116.
Isobates varicornis: Latzel 1884: 240–243, Loksa 1957: 194.
Nemasoma varicorne: Enghoff 1985: 41.

Localities. Megyaszó, Hernád-part (Tátorjános TVT); Regéc, Rostalló.

Remarks. The species had only two occurrences with 6 specimens, probably due to the use of pitfall traps. It was found in softwood inundation forests (*Salicetum* and *Alnetum*). *N. varicorne* is a bark-dwelling species (Blower 1985), in Hungary moderately common (Korsós 1994).

Blaniulidae

Proteroiulus fuscus (Am Stein, 1857)

Blaniulus fuscus Am Stein, 1857: 139.
Blaniulus pulchellus Porat, 1889: 82.
Amsteinia fuscum: Verhoeff 1911: 539–540.
Proteroiulus fuscus: Korsós 1994: 37.

Localities. Sátoraljaújhely, Ungvári pincék.

Remarks. We found two specimens (one female and one juvenile) in a cellar in Sátoraljaújhely. The species often occurs around human settlements in Hungary (Korsós 1992, 1994), and favors synanthropic localities elsewhere, too (e.g. Riedel *et al.* 2009). However, it can be widespread in natural and seminatural forests in Europe (Schubart 1934, Blower 1985, Kime 1990, 2004). Some authors (e.g. Voigtländer 2011) classify the species as eurytopic, woodland species without obvious preferences.

Julidae

Brachyiulus bagnalli (Brolemann, 1924)

Iulus pusillus Leach, 1815: 379 *sensu* Latzel 1884: 281–283.
Brachyiulus (Microbrachyiulus) pusillus: Verhoeff 1898: 152–153.
Microbrachyiulus bagnalli: Brolemann, 1924: 108.
Brachyiulus bagnalli: Dziadosz 1964: 207–209, Korsós 1994: 37–38, Bogyó & Korsós 2009: 414, 416.
Brachyiulus pusillus kaszabi Loksa, 1956: 389.

Localities. Bodroghalom, Medvetanya; Mezőzombor, Szarkatanya; Szentistvánbaksa, Baksahalom; Tarcal, Ördög-bánya, Vizsoly, Hernádholtág; Zalkod, Palocsa.

Remarks. The species was found in a few localities at low altitudes in the regions of Bodrogköz and the Hernád valley. The localities are mostly on the floodplains of the rivers Hernád, Tisza and Bodrog with more or less open vegetation (floodplain forests, grasslands, vineyards). *Brachyiulus bagnalli* was characterized by Dziadosz (1964) as a Southeast European steppe species. The species was previously recorded from Hungary (Loksa 1956, Korsós 1994, Korsós *et al.* 2002, Bogyó & Korsós 2009). It seems that *B. bagnalli* has a wide habitat preference, occurring in xerothermic grasslands, floodplain forests, and anthropogenic habitats like city parks as well.

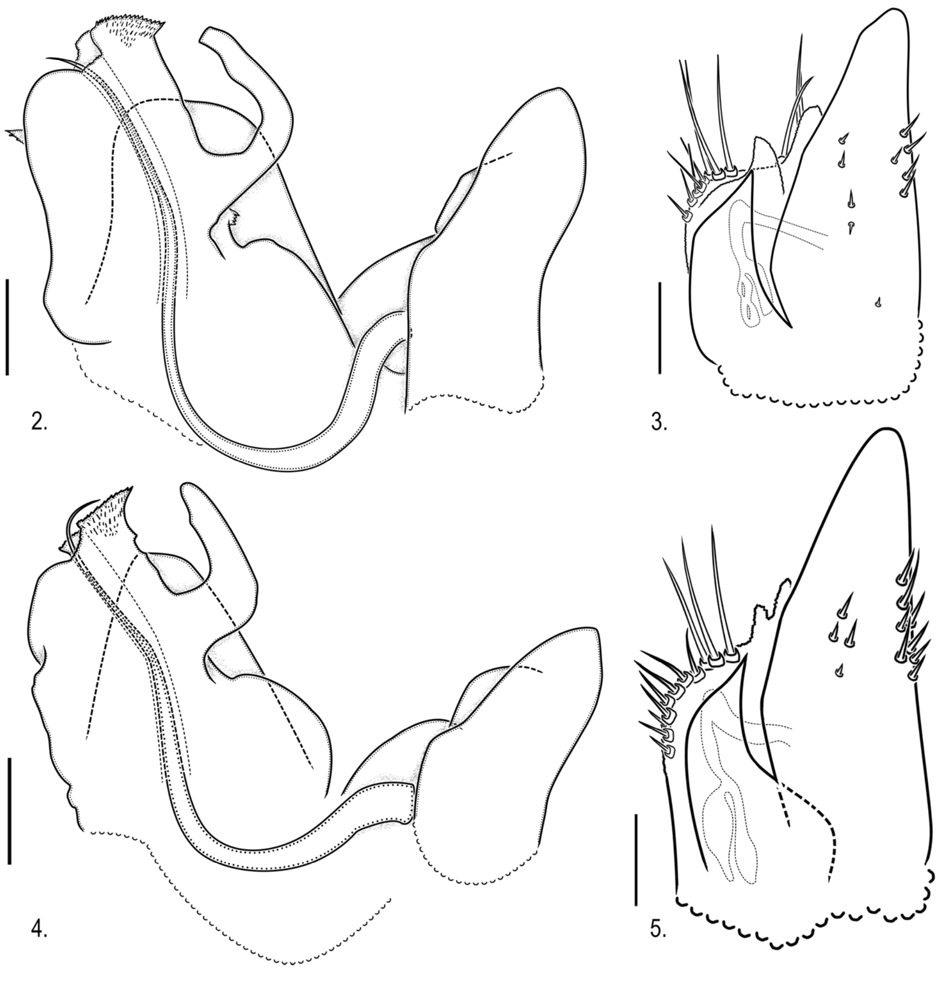
Cylindroiulus burzenlandicus Verhoeff, 1907

(Figures 2–5)

Cylindroiulus burzenlandicus Verhoeff, 1907: 310–311.
Cylindroiulus luridus burzenlandicus: Ložek & Gulička 1962: 63–66, 68, 78.
Cylindroiulus burzenladicus: Schubart 1934: 214, Bielak-Oleksy & Stojałowska 1968: 20–21.

Localities. Bózsva, Szuha-völgy, Füzér, Bodórét; Füzér, Halyagos-rét; Füzér, Oláh-rét; Hejce, Sólyom-kő, Nagyhuta, Káváskúti-völgy.

Remarks. This species is new to the Hungarian fauna! Altogether 13 specimens were found from 7 localities in the northern Zemplén Mountains. These sites are situated in natural beech forests and in a mountain hay meadow (Füzér, Bodó-rét). *C. burzenlandicus* was described from montane forests around Braşov (formerly Kronstadt), Romania (Verhoeff 1907). It is a Carpathian element, with relatively narrow range: adjoining parts of Poland, Slovakia, Ukraine and Romania (e.g., Jędryczkowski 1992, Mock 2001, Kosyanenko 2003, Kosyanenko & Chumak 2008, Enghoff & Kime 2009). In the neighboring Slovakia and Ukraine the species is typical for old montane beech forests, with a maximum abundance at about 600m a.s.l. in the Ukrainian Carpathians (Kosyanenko & Chumak 2008, Mock 2011 pers. comm.). Reexamination of specimens formerly identified as *C. luridus* from the Zemplén Mountains (2♂, 3♀ Rostalló, 1986. July 23., sifting; 3♂, 2♀, 2 juv., Rostalló, 1986. July 21–25., soil trap; 2♂ Komlóska valley, 1986. July 22., all leg. and det. by Z. Korsós, see Korsós (1994) proved that they are in fact *C. burzenlandicus*. Here we present new illustration of the male gonopods (Fig. 2), illustration for the first time of the female vulvae (Fig. 3), to compare it to the very similar *C. luridus* (Figs. 4–5, gonopods and vulvae, respectively.)



Figures 2–3. *Cylindroiulus burzenlandicus* Verhoeff, 1907 from Nagyhuta, Kávás-völgyi kút (Hungary). 2 = male right gonopods, mesal view. 3 = female right vulva, anterior view.

Figures 4–5. *Cylindroiulus luridus* (C. L. Koch, 1847) from Tardosbánya, Bánya-hegy (Hungary). 4 = male right gonopods, mesal view. 5 = female right vulva, anterior view (scale bars: 0.2 mm).

Enantiulus nanus **(Latzel, 1884)**

Julus nanus Latzel, 1884: 264–267.
Leptophyllum nanum: Verhoeff 1910: 56, Loksa 1968b: 266–288, 1979: 88, 91.
Enantiulus nanus: Hoffman 1980: 110, Korsós 1994: 43.

Localities. Háromhuta, Flórika-forrás; Pusztafalu, Kertek alja.

Remarks. In spite of the species' relatively high abundance in other northeastern Hungarian mountainous regions (Loksa 1968a, Lazányi & Korsós 2009) we have found only three specimens in the northern part of the Zemplén Mountains, in hornbeam forests. Since it is a small soil- and rock-dwelling species, this can be the result of the pitfall collecting method.

Julus terrestris **Linnaeus, 1758**

Julus terrestris Linnaeus, 1758: 639.
Julus terrestris Loksa 1973: 81, 1988: 170.
Iulus (L.) terrestris: Szabó 1931: 15, 18, 25–26, 28.

Localities. Alsóberecki, Berecki híd; Bodroghalom, Medvetanya; Felsőberecki, Bodrog-ártér; Fony, Tekenős; Hernádkércs, Hernád (füzes); Hernádnémeti, Török-jussa; Karcsa, Tekerületi-dűlők; Karos, Móka-domb; Karos, Szőlő-máj homok; Kenézlő, Görbe-ér; Kovácsvágás, Somoska; Megyaszó, Hernád-part (Tátorjános TVT); Mezőzombor, Kamara-rét; Olaszliszka, Fenyér; Regéc, Rostalló; Regéc, Bálint-hegy; Sárazsadány, Törökér; Sárospatak, Déli-Bodrog-holtág; Sárospatak, Kapronca; Sátoraljaújhely, Mocsolya; Sátoraljaújhely, Long-erdő (Háromhonvéd-fa); Telkibánya, Kecske-hát; Vajdácska, Diófás-dűlő; Zalkod, Palocsa; Zemplénagárd, Vér-tó.

Remarks. This is an abundant species in localities with open vegetation at low altitudes. It was found mainly on the floodplains and agricultural fields of Bodrogköz and the Hernád valley, sometimes in mass occurrence. In the Zemplén Mountains only a few records were found. *J. terrestris* is a typical millipede species of the Great Hungarian Plain (Korsós 1994) and other Eastern European open lowland areas (e.g. Jedryczkowsky 1992).

Kryphioiulus occultus **(C. L. Koch, 1847)**

Allajulus occultus C. L. Koch, 1847: 117–118.
Cylindroiulus occultus: Verhoeff 1907: 284, Loksa 1953: 179.
Kryphioiulus occultus: Read 1990: 107, Korsós 1994: 41.

Localities. Dámóc, Darvasi-legelő; Karos, Séta-homoki dűlő; Lácacséke, Ereszvény-dűlő.

Remarks. This generally xerothermic and somewhat synanthropic species (Schubart 1934, Korsós 1992, Bogyó & Korsós 2009, Riedel *et al.* 2009, Voigtländer 2011) was found at three sampling sites with only a few specimens. The localities belong to the low altitude landscape type of the Bodrogköz on sandy soil.

Leptoiulus cibdellus **(Chamberlain, 1921)**

Julus minutus Porat, 1889: 130–132.
Julus (Leptoiulus) minutus: Verhoeff 1898: 136.
Leptoiulus minutus: Vehoeff 1908: 436.
Iulus cibdellus Chamberlin, 1921: 83.
Leptoiulus cibdellus: Enghoff 1974: 31, Korsós 1994: 40.

Localities. Cigánd, Póherei-dűlő; Olaszliszka, Fenyér; Sátoraljaújhely, Gyalmos; Sátoraljaújhely, Long-erdő (Háromhonvéd-fa); Sátoraljaújhely, Mocsolya; Telkibánya, Kecske-hát; Vajdácska, Diófás-dűlő; Vajdácska, Holt-Bodrog; Zalkod, Palocsa.

Remarks. We have found the species in 9 localities with 15 specimens. The localities are mostly in diverse wetland habitats of the Bodrogköz. The species occurred in the Zemplén Mountains in several places, too. Our findings correspond to the results of previous works which stated that the species occurs mostly in wet woodlands across Central and North Europe, and has the ability to survive submersion during flood (Zulka 1991, Jędryczkowski 1992, Sallai 1993, Enghoff & Kime 2009).

Leptoiulus liptauensis **(Verhoeff, 1899)**

(Figure 6)

Julus (Leptoiulus) ciliatus liptauensis Verhoeff, 1899: 201.
Leptoiulus liptauensis: Verhoeff 1908: 440, Bielak-Oleksy & Stojałowska 1968: 21–23, Tajovský 1997: 229, Mock 2001: 31.

Localities. Bózsva, Farkas-völgy; Füzér, Vár-

forrás; Háromhuta, Flórika-forrás; Pusztafalu, Kertek alja; Sátoraljaújhely, Kecske-hát.

Remarks. This species is new to the Hungarian fauna! Altogether 13 specimens were found in five localities. All the sites are situated in closed deciduous woodlands in the Zemplén Mountains, between 320 and 480m a.s.l. *L. liptauensis* was described from alpine ranges (1350–2000m a.s.l.) of the Nizke Tatry, Vysoke Tatry and Zapadne Tatry Mountains, Slovakia (Verhoeff 1899). Later Gulička (1975) found the species in a collapsed cave (Duča) in the Slovak Paradise (about 950m a.s.l.) in Slovakia. It was mentioned from Poland as well; Krkonoše/Karkonosze Mts, Western Sudets (e.g. Stojałowska & Staręga 1974). *L. liptauensis* was formerly described as a western Carpathian species, occurring exclusively in alpine and subalpine ecosystems, typical mainly to alpine coniferous woodlands and dwarf shrub heaths (Jawlowsky 1938, Gulička 1956, Tajovský 1997). In spite of these statements Mock (1999) recorded its occurrence in eastern Slovakia from lower altitudes (440–500m a.s.l.) and from deciduous forests (Slanské vrchy Mountains: localities Zámutovská jelšina and Dolina obrov). Zemplén Mts may represent the southernmost occurrence of this Carpathian endemism. In agreement with Mock (1999) we found that the species usually occurs together with *Cylindroiulus burzenlandicus*, *Megaphyllum projectum*, *Unciger foetidus*, *Strongylosoma stigmatosum* and *Polydesmus complanatus* at this altitude and vegetation type. However, in the Zemplén Mountains it was found in four sampling sites together with *Leptoiulus proximus* as well. The ecological background of these co-occurrences has not yet been clarified.

Here we present a new gonopod figure of the species (Fig. 6). Unfortunately those samples which contained females were from regions where other *Leptoiulus* species occurred too, thus we are not able to give the details of female vulvae. The outer morphology of female vulva was already described by Bielak-Oleksy & Stojałowska (1968).

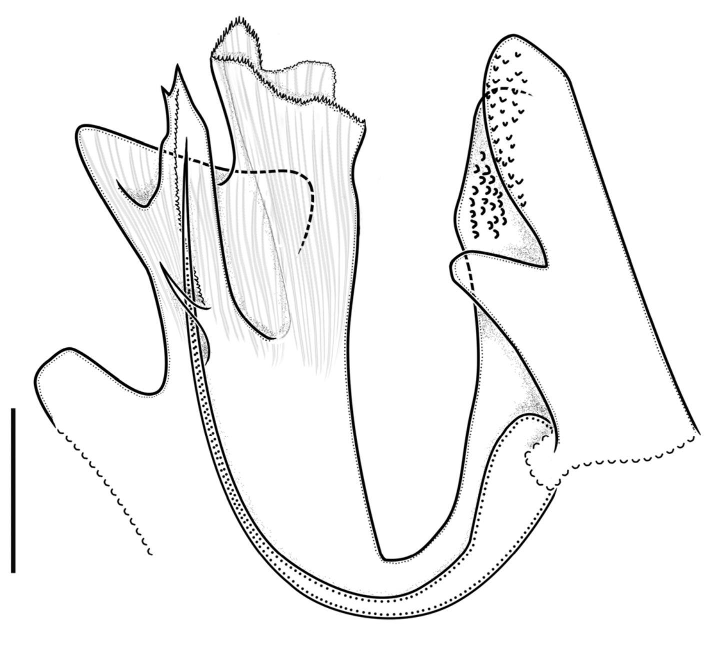


Figure 6. *Leptoiulus liptauensis* (Verhoeff, 1899) from Háromhuta, Flórika-forrás (Hungary). Male right gonopod, mesal view (scale bar: 0.2 mm).

Leptoiulus proximus (Nemec, 1896)

Julus (Leptoiulus) proximus Nemec, 1896: 3–4.
Julus (Leptoiulus) ciliatus buekkensis: Verhoeff 1899: 201.
Leptoiulus trilobatus buekkensis: Verhoeff 1908: 441.
Leptoiulus proximus: Attems 1927: 137, Loksa 1979: 88, 91.

Localities. Alsóregmec, Debrai-forrás; Fony, Fekete-patak; Fony, Tekenős; Füzér, Drahos; Füzér, Kerékgyártó bükk; Füzér, Torok; Füzér, Vár-forrás; Háromhuta, Flórika-forrás; Hejce, Sólyom-kő; Pusztafalu, Kertek alja; Sárospatak, Veres-haraszt; Sátoraljaújhely, Gyalmos; Sátoraljaújhely, Kecske-hát; Sátoraljaújhely, Long-erdő; Sátoralja-újhely, Lőtéri-forrás; Telkibánya, Kecske-hát; Zsujta, Haraszka.

Remarks. L. proximus was found in 17 localities of the Zemplén Mountains, with 58 specimens. It was found in different types of undisturbed forests (mainly alderwood, beech, oak-hornbeam) and mountain meadows, in some sites together with *L. cibdellus*, *L. liptauensis* and *L. trilobatus*. *L. proximus* is a widespread forest species in Hungary (Korsós 1994) and in Central and East Europe as well (Enghoff & Kime 2009). It prefers different forest types, mainly with multilevel tree and/or shrub layers (e.g. Schubart 1934, Jedryczkowsky 1992, Wytwer *et al.* 2009, Voigtländer 2011).

Leptoiulus trilobatus (Verhoeff, 1894)

Julus trilobatus Verhoeff, 1894a: 12.
Julus (Leptoiulus) ciliatus Verhoeff, 1897b: 115–116.
Leptoiulus trilobatus: Verhoeff 1908: 440, Korsós 1994: 40.

Localities. Füzér, Halyagos-rét; Hejce, Sólyom-kő; Sátoraljaújhely, Gyalmos.

Remarks. L. trilobatus was found in three localities of the Zemplén Mountains, with 37 specimens. In the 110 years old alderwood grove (*Alnetum*) of Gyalmos (Sátoraljaújhely) it occurred together with *L. cibdellus* and *L. proximus*. *L. trilobatus* has a Central European distribution (Enghoff & Kime 2009). In Hungary it prefers mostly the closed, undisturbed forests (Lazányi & Korsós 2009). However, other studies described it as an „adaptable" species (Tuf & Tufová 2008).

Megaphyllum projectum projectum Verhoeff, 1894

Megaphyllum projectum Verhoeff, 1894b: 323–324.
Brachyiulus projectus: Verhoeff 1897b: 111–112.
Chromatoiulus projectus: Schubart 1934: 278-280, Loksa 1979: 88.
Brachyiulus projectus dioritanus Verhoeff, 1907: 303, 305, Figs 5–8.
Chromatoiulus projectus dioritanus: Loksa 1968a: 268.
Megaphyllum projectum dioritanum: Loksa 1988: 164, 1991: 131–132.
Megaphyllum projectum: Hoffman 1980: 104.
Megaphyllum projectum projectum: Lazányi & Korsós 2011: 45–49, 51–53.

Localities. Dámóc, Őrhegy; Dámóc, Darvasi-legelő; Füzér, Drahos; Füzér, Vár-forrás; Füzér, Torok; Füzér, Kerékgyártó-bükk; Füzérradvány, Arborétum; Háromhuta, Flórika-forrás; Monok, Csörgő-domb; Pusztafalu, Kertek alja; Regéc, Rostalló; Sátoraljaújhely, Kecske-hát; Sátoraljaújhely, Májuskút, szőlő; Sátoraljaújhely, Boda-dűlő; Telkibánya, Kecske-hát; Vilyvitány, Magócsa-patak.

Remarks. This is an abundant julid species in the research area. It lives in the deciduous forests of the Zemplén Mountains, and it was also found in an oak woodland of the Hernád valley (Monok). It is widespread in Hungary as well as in Central and Eastern Europe (Korsós 1994, Enghoff & Kime 2009). In the Eastern European Plain the species is closely associated to the oak woodlands (Wytwer *et al.* 2009), but seems to be more eurytopic in Western Europe (Voigtländer 2011).

Megaphyllum unilineatum (C. L. Koch, 1838)

Iulus unilineatus C. L. Koch, 1838: 22.
Brachyiulus (Chromatoiulus) unilineatus: Verhoeff 1897b: 114–115.
Brachyiulus unilineatus: Szabó 1931: 15, 18, 22–24, 26–28, 30.
Chromatoiulus unilineatus: Attems 1927: 220.
Chromatoiulus unilineatus: Loksa 1953: 179; 1983: 68.
Megaphyllum unilineatum: Hoffman 1980: 104, 113, Loksa 1988: 162–164, 170.

Localities. Abaújszántó, Sátor-hegy; Abaújszántó, Kassi-szőlő; Baskó, Tekeres-patak; Bodroghalom, Medvetanya; Dámóc, Darvasi-legelő; Füzér, Drahos; Gesztely, Ürmös-hát; Hernád-

németi, Török-jussa; Karos, Móka-domb; Mád, Becsek; Mezőzombor, Szarkatanya; Pusztafalu, Kertek alja; Tarcal, Ördög-bánya; Újcsanálos, Ó-csanálosi part; Vilmány, Középső-mező; Vizsoly, Hernád-holtág.

Remarks. The species was relatively abundant in the lower altitude habitats of the study area. *M. unilineatum* occurred mainly in the Hernád valley, but it could be found in the Zemplén Mountains and in Bodrogköz, too. It was also abundant in disturbed, anthropogenic habitats. In Europe and in Hungary it is a generally widespread, xerothermic open land species (e. g. Korsós 1994, Tuf & Tufová 2008, Enghoff & Kime 2009, Voigtländer 2011).

Ommatoiulus sabulosus (Linnaeus, 1758)

Iulus sabulosus Linnaeus, 1758: 640.
Julus (Ommatoiulus) sabulosus: Haase 1887: 27–29.
Schizophyllum sabulosum: Verhoeff 1900: 466–473.
Archiulus sabulosus: Attems 1927: 240, 279–282.
Ommatoiulus sabulosus: Jeekel 1968, Korsós 1994: 43.

Localities. Bózsva, Farkas-völgy; Füzér, Drahos; Háromhuta, Márika-forrás; Pusztafalu, Kertek alja.

Remarks. The species had four occurrences with 28 specimens altogether. All localities were in natural forest habitats of the northeastern part of the Zemplén Mountains. It occurs in a wide range of habitats (from open grasslands to different forest types) across Europe (e.g. Blower 1985, Jędryczkowski 1992, Kime 1992, 1996, Wytwer *et al.* 2009, Voigtländer 2011). In Eastern Hungary it is less abundant. Nevertheless, former studies (Korsós 1994, Mock 1999) showed that it was already found close to our present localities.

Unciger foetidus (C. L. Koch, 1838)

Iulus foetidus C. L. Koch, 1838: 22.
Oncoiulus foetidus: Verhoeff 1899: 190–191.
Unciger foetidus: Lohmander 1925: 60–61, Loksa 1953: 179.

Localities. Füzér, Bodó-rét; Füzér, Drahos; Füzér, Halyagos; Füzér, Kerékgyártó-bükk; Füzér, Vár-forrás; Háromhuta, Flórika-forrás; Hejce, Sólyom-kő, Nagyhuta, Káváskúti-völgy.

Remarks. This species was recorded from 8 localities in the central part of the Zemplén Mountains in undisturbed natural forest habitats. In northwestern areas of Europe it tends to be eurytopic (Voigtländer 2011) and sometimes synanthropic (Lindner *et al.* 2010), but in Hungary it is more confined to natural forests (e.g. Korsós 1994, Lazányi & Korsós 2009).

POLYDESMIDA

Paradoxosomatidae

Strongylosoma stigmatosum (Eichwald, 1830)

Julus stigmatosus Eichwald, 1830: 124.
Strongylosoma pallipes (Olivier, 1792): Latzel 1884: 168–170, Loksa 1953: 179.
Strongylosoma stigmatosum: Jeekel 1967: 166, Szlávecz & Loksa 1991: 804.

Localities. Füzér, Vár-forrás; Füzér, Oláh-rét; Füzér, Halyagos-rét; Füzérradvány, Arborétum; Háromhuta, Huta-völgyi-kút; Hejce, Sólyom-kő.

Remarks. The species was found in six localities which represent undisturbed woodland habitats in the Zemplén Mountains. This species is widespread in hilly and montane forests in Hungary and in East Central and East Europe as well (e.g. Jędryczkowski 1992, Korsós 1994, Enghoff & Kime 2011, Lazányi & Korsós 2009).

Polydesmidae

Brachydesmus dadayi Verhoeff, 1895

Brachydesmus dadayi Verhoeff, 1895: 287–288.
Brachydesmus dadayi: Korsós, 1994: 44.

Localities. Tarcal, Ördög-bánya.

Remarks. A single male specimen was found in the mixture of a former vineyard and natural grassland area near an abandoned quarry. The species was described by Verhoeff (1895) from Slovakia (Zlaté Moravce). It is endemic to the Carpathian Basin (Korsós 1998) with relatively few occurrences, but was also found in synanthropic habitats (Korsós 1992).

***Polydesmus complanatus* (Linnaeus, 1761)**

Julus complanatus Linnaeus, 1761: 502.
Polydesmus illyricus Verhoeff, 1893: 273–275.
Polydesmus complanatus: Porat 1870: 820, Lohmander 1925: 16–17, Szabó 1931: 15, 17–18, 21–22, 25–29, Loksa 1954: 217–218.

Localities. Abaújszántó, Kassi-szőlő; Abaújszántó, Sátor-hegy; Alsóberecki, Berecki híd; Alsóregmec, Köblös és Szompoly; Cigánd, Póhereidűlő; Felsőberecki, Bodrog-ártér; Füzér, Drahos; Füzér, Halyagos-rét; Füzér, Vár-forrás; Füzérradvány, Arborétum; Füzérradvány, Fülemülevölgy; Háromhuta, Flórika-forrás; Hernádkércs, Hernád (füzes); Kéked, Kékedfürdő; Mád, Becsek; Megyaszó, Hernád-part (Tátorjános TVT); Monok, Csörgő-domb; Pácin, Mágócsikastély; Pusztafalu, Kertek alja; Regéc, Rostalló; Sárazsadány, Törökér; Sárospatak, Keleti-Bodrogholtág, Sárospatak, Veresharaszt; Sátoraljaújhely, Boda-dűlő; Sátoraljaújhely, Gyalmos; Sátoraljaújhely, Kacsa-tó; Sátoraljaújhely, Kecske-hát; Sátoraljaújhely, Long-erdő (Háromhonvéd-fa); Sátoraljaújhely, Májuskút, szőlő; Sátoraljaújhely, Mocsolya; Sátoraljaújhely, Ungvári pincék; Tarcal, Ördög-bánya; Telkibánya, Kecske-hát; Tiszakarád, Szárnya-szög; Tokaj, Rákóczi-vár; Vágáshuta, Nagypart; Vajdácska, Kopaszló-sarok; Vilyvitány, Magócsa-patak; Vilyvitány, Vilyilegelő; Vizsoly, Hernád-holtág; Zalkod, Palocsa; Zemplénagárd, Vér-tó; Zsujta, Haraszka.

Remarks. Common and widespread millipede species in the region, found altogether in 42 localities. It occurs in almost every kind of habitats, and is common in Central–Eastern Europe and in Hungary, too (Tadler & Thaler 1993, Korsós 1994, 1998, Tuf & Tufová 2008, Enghoff & Kime 2011).

***Polydesmus denticulatus* C. L. Koch, 1847**

Polydesmus denticulatus C. L. Koch, 1847: 135.
Polydesmus denticulatus: Szabó 1931: 15, 17–18, 26–27, 30, Loksa 1954: 217, 220.

Localities. Alsódobsza, Erős-domb; Bodroghalom, Medvetanya; Dámóc, Darvasi-legelő; Fony, Fekete-patak; Füzér, Drahos; Gesztely, Ürmöshát; Hernádbűd, Gaz; Hernádnémeti, Török-jussa; Mád, Becsek; Mezőzombor, Szarkatanya; Monok, Ingvár; Monok, Csörgő-domb; Olaszliszka, Fenyér; Sárazsadány, Törökér; Sárospatak, Füzes-ér; Sátoraljaújhely, Mocsolya; Sátoraljaújhely, Kacsató; Szentistvánbaksa, Baksa-halom; Telkibánya, Kecske-hát; Tiszakarád, Szárnya-szög; Vágáshuta, Nagypart; Vajdácska, Kopaszló-sarok; Vizsoly, Hernád-holtág; Zalkod, Palocsa.

Remarks. This is the most abundant millipede species in the research area, found in 22 localities. In many cases the species was found at low altitudes under human disturbance. In 12 localities it was found together with *P. complanatus*. *P. denticulatus* is an eurytopic species, widespread in Hungary and in Europe, sometimes in synanthropic habitats, too (Tadler & Thaler 1993, Korsós 1994, Enghoff & Kime 2011).

DISCUSSION

The present study lists 25 species with 1370 individuals from the Zemplén Mountains and its surroundings, i.e. 24,3% of the Hungarian millipede fauna (Korsós 2005). The regular use of pitfall trapping may explain this relatively low number of species. Although we worked with 92 sampling sites, some interesting localities were particularly missing from the research area, like the central and southwestern parts of the Zemplén Mountains, and the southeastern, more or less isolated point of the mountains (the Tokaj Hill). All these are protected under the Hungarian nature conservation law.

With the two new species, recorded for the first time, the actual number of Hungarian millipede species increases to 103 (Korsós 2005, Korsós unpublished).

Most of the recorded species (64%) can be characterized as (undisturbed) forest species. The number of eurytopic species (found sometimes also in synanthropic habitats) like *Proteroiulus fuscus* and *Polydesmus denticulatus* was low (8 %), *P. denticulatus* was, however, one of the most abundant species in disturbed lowland areas. The (xerothermic) open land species, like *Brachyiulus*

bagnalli, *Julus terrestris*, *Kryphyioiulus occultus* and *Megaphyllum unilineatum* occurred mainly on the plains around the Zemplén Mountains. The most abundant five species were as it follows: *Polydesmus denticulatus*, *Polydesmus complanatus*, *Glomeris hexasticha*, *Julus terrestris*, *Megaphyllum projectum*.

In biogeographic relations, most of the recorded species (80%) are widespread; e.g. in Central and/or Eastern Europe. Three Carpathian species were found, two of them were new to the Hungarian fanua: *Cylindroiulus burzenlandicus* and *Leptoiulus liptauensis*; the third was *Brachydesmus daday*, endemic to the Carpathian Basin. *Glomeris tetrasticha* was the fourth montane species in our list.

In agreement with faunistical information based on other invertebrate taxa here we present new evidence that the forested habitats of the Zemplén Mountains are suitable for Carpathian faunal elements in Hungary. The forests of the Zemplén Mountains do have a biogeographic connection both with the Slovakian and Ukrainian part of the Carpathians as it was proven by other invertebrate taxa as well (e. g. Nagy *et al.* 1998, Dányi & Korsós 2002, Kontschán *et al.* 2006, Jordán *et al*. 2007, Sólymos 2008). As discussed by Mock (1999) and Lazányi & Korsós (2009) there is still a chance to find new species to the Hungarian millipede fauna in this region. Species occurring in the broader region of Eastern Slovakia, like the Carpathian *Trachysphaera acutula* (Latzel, 1884) and *Xestoiulus carpathicus* (Verhoeff, 1907) can also be expected in the territory of Hungary.

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REFERENCES

AM STEIN, J. H. (1857): Aufzählung und Beschreibung der Myriapoden und Crustaceen Graubündens. *Jahresbericht der Naturforschenden Gesellschaft Graubündens*, *Neue Folge* 2: 112–148.

ATTEMS, C. (1927): Über palaearktische Diplopoden. *Archiv für Naturgeschichte*, 92(1–2): 1–256.

BIELAK-OLEKSY, T. & STOJAŁOWSKA, W. (1968): Wulwy samicy jako cecha taksonomiczna gatunków rodzaju Cylindroiulus, Unciger i Leptoiulus (Diplopoda). *Folia Societatis Scientiarum Lublinensis*, B 7/8: 19–24. (in Polish)

BLOWER, J. G. (1985): *Millipedes.* Synopses of the British Fauna, N. S., No. 35, E. J. Brill, London, 242 pp.

BRANDT, J. F. (1833): Tentaminum quorundam monographicorum Insecta Myriapoda Chilognathi Latreillii spectantium prodromus. *Bulletin de la Societé Impériale des Naturalistes de Moscou*, 6: 194–209.

BRANDT, J. F. (1837): Note sur un ordre nouveau de la classe des Myriapodes et sur l'etablissement des sections de cette classe d'animaux en général. *Bulletin Scientifique publié par l'Académie Impériale des Sciences de Saint-Pétersbourg*, 1(23): 178–179.

BOGYÓ, D. & KORSÓS, Z. (2009): Effect of urbanization on millipedes (Diplopoda) – Faunistical results. *Természetvédelmi Közlemények*, 15: 412–421. (in Hungarian with English abstract)

BRÖLEMANN, H. W. (1924): Notes synonimiques (Myriapodes). *Bulletin de la Société d'histoire naturelle de Toulouse*, 52 (2): 101–111.

CHAMBERLAIN, R. V. (1921): The Julidae and Isobatidae in North America. *Proceedings of the Biological Society of Washington*, 34: 81–84.

DÁNYI, L. & KORSÓS, Z. (2002): *Lithobius cyrtopus* (Chilopoda: Lithobiomorpha, Lithobiidae), from the Zemplén Mts. new to the fauna of Hungary. *Folia Entomologica Hungarica*, 63: 186–188. (in Hungarian with English abstract)

DZIADOSZ, C. (1964): Eine für Polen neue Art von Tausendfüsslern, *Brachyiulus bagnalli* (Brölemann), (Diplopoda, Iulidae). *Bulletin de l'Academie Polonaise des Sciences*, Cl II., 12(5): 207–209.

EICHWALD, E. (1830): *Zoologia specialis. Pars altera.* Vilnae, pp. IV+ 233.

ENGHOFF, H. (1974): Om tusindbenenes udbredelse i Danmark (Diplopoda). *Entomologiske Meddelelser*, 42: 21–32. (in Danish with English summary)

ENGHOFF, H. (1985): The millipede family Nemasomatidae. With the description of a new genus, and a

revision of *Orinisobates* (Diplopoda: Julida). *Entomologica scandinavica*, 16: 27–67.

ENGHOFF, H. & KIME, R. D. (2009): *Fauna Europaea: Diplopoda.* Fauna Europaea version 2.0, http://www.faunaeur.org. (accessed 17. August 2011)

ENGHOFF, H. & KIME, R. D. (2011): *Atlas of European Millipedes (Class Diplopoda). Volume 1. Orders Polyxenida, Glomerida, Platydesmida, Siphonocryptida, Polyzoniida, Callipodida, Polydesmida.* Pensoft Publishers, Sofia–Moscow & European Invertebrate Survey, Leiden, pp. 282.

GULIČKA, J. (1956): Nový druh Diplopod z Tatier. [New species of Diplopoda from the Tatry Mts.] *Acta Facultatis rerum naturalium Universitatis Comenianae*, *Zoologia* 1: 93–96. (in Slovakian with Russian and German summary)

GULIČKA, J. (1975) Fauna slovenských jaskýň. [Fauna of Slovak caves.] *Slovenský kras*, 13: 37–85. (in Slovakian, with Russian and German summary)

HAASE, E. (1887): Schlesiens Diplopoden. Zweite Hälfte. *Zeitschrift für Entomologie*, *Neue Folge*, 12: 1–46.

HELLER, C. (1858): Beiträge zur österreichischen Grotten-Fauna. *Sitzungsberichte der Mathematisch-Naturwissenschaftlichen Classe der Kaiserlichen Akademie der Wissenschaften*, Wien 26 (1): 313–326.

HOESS, R. (2000): Bestimmungschlüssel für die *Glomeris*-Arten Mitteleuropas und angrenzender Gebiete. *Jahrbuch des Naturhistorischen Museums Bern*, 13: 3–20.

HOESS, R. & SCHOLL, A. (2001): Allozyme and literature study of *Glomeris guttata* Risso, 1826, and *Glomeris connexa* Koch, 1847, a case of taxonomic confusion (Diplopoda: Glomeridae). *Zoologischer Anzeiger*, 240: 15–33.

HOFFMAN, R. L. (1980): *Classification of the Diplopoda*. Muséum d'Histoire Naturelle Genève, pp. 237.

JAWŁOWSKI, H. (1938): Materiały do znajomości fauny krocionogów (Diplopoda) tatrzańskich. (Beiträge zur Kenntnis der Diplopodenfauna des Tatra-Gebirges.) *Fragmenta faunistica*, 3(17): 315–343. (in Polish with German summary)

JEEKEL, C. A. W. (1967): Notes on the nomenclature and taxonomy of European Paradoxosomatidae (Diplopoda, Polydesmida). *Entomologische Berichten*, 27: 166-172.

JEEKEL, C. A. W. (1968): The generic and subgeneric names of the European Julidae generally referred to *Schizophyllum* Verhoeff, 1895 (Diplopoda, Julidae). *Entomologische Berichten*, 28: 49–51.

JEEKEL, C. A. W. (1971): *Nomenclator generum et familiarum Diplopodorum: A list of the genus and family-group names in the class Diplopoda from the 10th edition of Linnaeus, 1758, to the end of 1957*. Monografieen van de Nederlandse Entomologische Vereniging No. 5 pp. 412.

JERMY, T. (1942): Rendszertani tanulmány a Magyarországi plesioceratákról. (Diplopoda) (Systematische Studien an ungarländischen Plesioceraten (Diplopoda).) *Matematikai és Természettudományi Közlemények*, 39: 1–82. (in Hungarian, with German summary)

JĘDRYCZKOWSKI, W. B. (1992): The distribution and ecology of the millipedes in Poland. *Berichte des naturwissenschaftlich-medizinischen Vereins in Innsbruck*, Suppl. 10: 385–391.

JORDÁN, F., MAGURA, T., TÓTHMÉRÉSZ, B., VASAS, V. & KÖDÖBÖCZ, V. (2007): Carabids (Coleoptera: Carabidae) in a forest patchwork: a connectivity analysis of the Bereg Plain landscape graph. *Landscape Ecology*, 22: 1527–1539.

KIME, R. D. (1990): A provisional atlas of European myriapods. Part 1. *Fauna Europaea Evertebrata*, 1: 1–109.

KIME, R. D. (1992): On abundance of West-European millipedes (Diplopoda). *Berichte des naturwissenschaftlich-medizinischen Vereins in Innsbruck*, Suppl. 10: 393–399.

KIME, R. D. (1996): Millipedes recorded in the Grand Duchy of Luxemburg. In: GEOFFROY, J. J., MAURIES, J. P. & NGUYEN DUY-JACQUEMIN, M. (eds.): *Acta Myriapodologica. Mémoires du Museum National d'Histoire Naturelle*, 169: 257–263.

KIME, R. D. (2004): The Belgian millipede fauna (Diplopoda). *Bulletin de l'institut royal des sciences naturelles de Belgique, Entomologie*, 74: 35–68.

KISS, G. (2007): Talajtani adottságok és értékek. [Soil capabilities and values] In: BARÁZ, CS. & KISS, G. (eds): *A Zempléni Tájvédelmi Körzet. Abaúj és Zemplén határán.* [The Zemplén Landscape Protection Area between the Zemplén and Abaúj Regions] BNPI, Eger, pp. 105-110. (in Hungarian)

KOCH, C. L. (1838): *Deutschlands Crustaceen, Arachniden und Myriopoden. Ein Beitrag zur deutschen Fauna.* Heft 22, Regensburg.

KOCH, C. L. (1847): System der Myriapoden mit den Verzeichnissen und Berichtigungen zu Deutschlands Crustaceen, Myriapoden und Arachniden. In: PANZER & HERRICH-SCHÄFFER, A.: *Kritische Revision der Insectenfaune Deutschlands*, III. Bändchen, Regensburg, pp. 196.

KONTSCHÁN, J., HEGYESSY G. & CSORDÁS B. (2006): Abaúj és Zemplén tájainak makroszkópikus rákjai (Crustacea). [Macroscopic crustaceans of regions of Abaúj and Zemplén (NE Hungary).] Abaúj-Zemplén Értékeiért Közhasznú Egyesület, Sátoraljaújhely, pp. 89. (in Hungarian)

KORSÓS, Z. (1992): Millipedes from anthropogenic habitats in Hungary (Diplopoda). *Berichte des naturewissenschaftlich-medizinischen Vereins in Innsbruck*, Suppl. 10: 237–241.

KORSÓS, Z. (1994): Checklist, preliminary distribution maps, and bibliography of millipedes in Hungary (Diplopoda). *Miscellanea zoologica hungarica*, 9: 29–82.

KORSÓS, Z. (1998): Az ikerszelvényesek (Diplopoda) faunisztikai és taxonómiai kutatásának helyzete és irányai Magyarországon. [Status and directions of faunistic and taxonomical research of millipedes in Hungary.] *Folia historico naturalia Musei Matraensis*, 22: 85–98. (in Hungarian with English summary)

KORSÓS, Z. (2005): The millipede fauna (Diplopoda) of Hungary: a zoogeographical account. *Abstracts of lectures and posters, 13th International Congress of Myriapodology*, 25–29 July 2005, Bergen, Norway, pp. 24.

KORSÓS, Z., HORNUNG, E., SZLÁVECZ, K. & KONTSCHÁN, J. (2002): Isopoda and Diplopoda of urban habitats: New data to the fauna of Budapest. *Annales historico-naturales Musei nationalis hungarici*, 94: 193–208.

KOSYANENKO, E. V. (2003): [Diplopoda and Chilopoda of the Carpathian National Park.] *Nature Reserves in Ukraine*, 9 (2): 60–63. (in Ukrainian)

KOSYANENKO, E. V. & CHUMAK, O. V. (2008): [Millipedes (Diplopoda) of primeval beech forests in the Carpathian Biosphere Reserve.] *Scientific Bulletin of the Uzhhorod National University, Series Biology*, 23: 182–193. (in Ukrainian with English summary)

LATREILLE, P. A. (1802–1804): *Histoire naturelle, générale et particulière des Crustacés et des Insectes.* Dufart, Paris, pp. 467.

LATZEL, R. (1884): *Die Myriopoden der Österreichisch-ungarischen Monarchie. Zweite Hälfte. Die Symphylen, Pauropoden und Diplopoden.* Alfred Hölder, Wien, pp. 414.

LAZÁNYI, E. & KORSÓS, Z. (2009): Millipedes (Diplopoda) of the Aggtelek National Park, northeastern Hungary. *Opuscula Zoologica*, Budapest, 40(1): 35–46.

LAZÁNYI, E. & KORSÓS, Z. (2011): Revision of the *Megaphyllum projectum* Verhoeff species complex (Myriapoda: Diplopoda: Julida: Julidae). *Zootaxa*, 2864: 43–56.

LEACH, W. E. (1815): A tabular view of the external characters of four classes of animals, which Linné arranged under Insecta; with the Distribution of the genera composing three of these classes into orders, and descriptions of several new genera and species. *Transactions of the Linnean Society of London*, 11(2): 306–400.

LINDNER, E. N., VOIGTLÄNDER, K., REIP, H. S. (2010): Hundert- und Tausendfüßer (Myriapoda: Chilopoda, Diplopoda) aus der Lüneburger Heide (Niedersachsen). Ergebnisse der Herbstexkursion 2008 der AG Deutschsprachiger Myriapodologen. *Schubartiana*, 4: 35–48.

LINNAEUS, C. (1758): *Systema Naturae per Regnia tria Naturae, secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis.* Editio 10, reformata. pp. 823.

LINNAEUS, C. (1761*): Fauna Svecica sistens Animalia Sveciae Regni: Mammalia, Aves, Amphibia, Pisces, Insecta, Vermes.* Editio altera. Stockholm, XLVIII+ pp. 578.

LOHMANDER, H. (1925): Sveriges Diplopoder. *Göteborgs Kungliga Vetenskaps- och Vitterhets-Samhälles handlingar, 4. Följden* 30(2): 1–115.

LOKSA, I. (1953): Bátorliget ikerszelvényes-faunája, Diplopoda. [Millipede fauna of Bátorliget, Diplopoda.] In: SZÉKESSY, V. (ed.): *Bátorliget élővilága. [The fauna and flora of Bátorliget.]* Akadémiai Kiadó, Budapest, pp. 178–181. (in Hungarian)

LOKSA, I. (1954): Die Polydesmus-Arten des Faunengebietes des Karpatenbeckens. *Annales historico-naturales Musei nationalis hungarici*, 5: 215–224.

LOKSA, I. (1956): The diplopod and chilopod faunas of the environs of Lake Velence. *Annales historico-naturales Musei Nationalis Hungarici*, 7: 385–390.

LOKSA, I. (1957): Ergebnisse der Überprüfung einer Diplopodensammlung von J. Daday. *Annales Universitatis Scientiarum Budapestinensis de Rolando Eötvös Nominatae, Sectio Biologica*, 1: 189–195.

LOKSA, I. (1959): Ökologische und faunistische Untersuchungen in der Násznép-Höhle des Naszály-Berges. Biospeologica Hungarica, VI. *Opuscula Zoologica*, *Budapest*, 3: 63–80.

LOKSA, I. (1968a): Einige Diplopodenformen aus Ungarn. *Opuscula Zoologica*, *Budapest*, 8(1): 57–62.

LOKSA, I. (1968*b*): Quantitative Makrofauna-Untersuchungen in den Waldböden des Bükkgebirges (Ungarn). *Annales Universitatis Scientiarum Budapestinensis de Rolando Eötvös Nominatae, Sectio Biologica*, 9–10: 266–289.

LOKSA, I. (1973): Bodenzoologische Untersuchungen in den Alkali-Waldsteppen von Margita, Ungarn. I. Untersuchungen der Arthropoden-Makrofauna, nebst Bemerkungen über die Oniscinea-Arten. *Opuscula zoologica*, *Budapest*, 11: 79–93.

LOKSA, I. (1979): Quantitative Untersuchungen über die Makrofauna der Laubstreu in Zerreichen- und Hainsimsen-Eichen-Beständen des Bükk-Gebirges. *Opuscula zoologica*, *Budapest*, 16: 87–96.

LOKSA, I. (1988): Über einige Arthropoden-Gruppen aus dem Biosphäre-Reservat des Pilis-Gebirge (Ungarn) 1. Die Diplopoden, Chilopoden, Weberknechte und Spinnen vom Szamár-Berg. *Opuscula zoologica*, *Budapest*, 23: 159–176.

LOŽEK, V. & GULIČKA, J. (1962): Gastropoda, Diplopoda a Chilopoda slovenskéj casti Východných Karpát. [Gastropoda, Diplopoda und Chilopoda der slowakischen Ostkarpaten.] *Acta Facultatis rerum naturalium Universitatis Comenianae*, Zoologia, 7 (1–2): 61–93. (in Slovakian with Russian and German summary)

MOCK, A. (1999): [Mnohonozky (Myriapoda, Diplopoda) vybranych lokalit vychodneho Slovenska 1.] *Natura Carpatica*, 40: 217–224. (in Slovakian)

MOCK, A. (2001): Millipedes of the Slovak Republic. *Myriapodologica Czecho-Slovaca,* 1: 25-38.

NAGY, B., SUSLIK, V. & KRISTIN, A. (1998): Distribution of Orthoptera species and structure of assemblages along Slanské-Zemplén Mts. gradient (SE Slovakia – NE Hungary). *Folia entomologica hungarica*, 61: 17–27.

NÉMEC, B. (1896): Zur Kenntnis der Diplopoden Böhmens. *Sitzungsberichte der königlichen böhmischen Gesellschaft der Wissenschaften, Mathematisch-naturwissenschaftliche Klasse*, 1896: 1–8.

PORAT, C. O. (1870): Om några Myriapoder från Azorerna. *Öfversigt af Kongliga Vetenskaps-Akademiens förhandlingar* 27(7): 813–823. (in Danish)

PORAT, C. O. (1889): Nya bidrag till skandinaviska halföns Myriapodologi. *Entomologisk tidskrift* 1889: 1–66. (in Danish)

READ, H. J. (1990): The generic composition and relationships of the Cylindroiulini – a cladistic analysis (Diplopoda, Julida: Julidae). *Entomologica scandinavica*, 21: 97–112.

RIEDEL, P., NAVRÁTIL, M., TUF, I. H., TUFOVÁ, J. (2009): Terrestrial isopods (Isopoda: Oniscidea) and millipedes (Diplopoda) of the City of Olomouc. In: TAJOVSKÝ, K., SCHLAGHAMERSKÝ, J. & PIŽL, V. (eds): *Contributions to Soil Zoology in Central Europe III.* Institute of Soil Biology, Biology Centre, ASCR, České Budějovice, p. 125–132.

SALLAI, A. (1993): Ecofaunistical investigations in a boggy forest in the Protected Landscape Area at Ócsa (Kiskunság National Park, Hungary). *Opuscula Zoologica*, *Budapest*, 26: 85–94.

SCHUBART, O. (1934): Tausendfüssler oder Myriapoda I: Diplopoda. In: DAHL, F. (ed.): *Die Tierwelt Deutschlands und der angränzenden Meeresteile, Teil 28.* Gustav Fischer Verlag, Jena, pp. 318.

SIMON, T. (2006): A Zempléni-hegység botanikai értékei. *Folia Historico Naturalia Musei Matrensis*, 30: 407–414. (in Hungarian, with German summary)

SÓLYMOS, P. (2008): Quantitative biogeographic characterization of Hungary based on the distribution data of land snails (Mollusca, Gastropoda): a case of nestedness of species ranges with extensive overlap of biotic elements. *Acta Zoologica Academiae Scientiarum Hungaricae*, 54 (3): 269–287.

STOJAŁOWSKA, W. & STARĘGA, W. (1974): Krocionogi Diplopoda. *Katalog Fauny Polski*, 14(2): 1–71.

STRASSER, K. (1966): Über Diplopoden Bulgariens. *Annales zoologici*, 23(12): 325–385.

SZLÁVECZ, K. & LOKSA, I. (1991): Diversity of soil arthropods in the Bátorliget Nature Reserve, Hungary. In: ZOMBORI, L. & PEREGOVITS, L. *Proceedings of 4th ECE/XIII. SIEEC, Gödöllő 1991*, p. 801–807.

SZABÓ, M. (1931): Szeged vidékének Myriopodái [Die Myriopoden der Umgebung von Szeged]. *Acta Biologica*, 2 (1): 14–31. (in Hungarian)

TADLER, A. & THALER, K. (1993): Genitalmorphologie, Taxonomie und geographische Verbreitung ostalpiner Polydesmida (Diplopoda, Helmithomorpha). *Zoologische Jahrbücher, Abteilung für Systematik, Ökologie und Geographie der Tiere* 120: 71–128.

TAJOVSKÝ, K. (1997): Distribution of millipedes along an altitudinal gradient in three mountain regions in the Czech and Slovak Republics (Diplopoda). In: ENGHOFF, H. (ed.): Many-legged animals - A collection of papers on Myriapoda and Onychophora - *Entomologica scandinavia*, Suppl. 51: 225–234.

TUBA, Z. & SZIRMAI, O. (2008): A magyarországi Bodrogköz (ÉK-Magyarország) kistáj természetrajza. *Folia Historico Naturalia Musei Matrensis* 32: 7–14.

TUF, I. H. & TUFOVA, J. (2008): Proposal of ecological classification of centipede, millipede and terrestrial isopod faunas for evaluation of habitat quality in Czech Republic. *Časopis Slezského zemského muzea, série A*, 57: 37–44.

VERHOEFF, K. W. (1893): Neue Diplopoden aus dem österreichischen Küstenlande. *Berliner Entomologische Zeitschriften*, 38: 267–278.

VERHOEFF, K. W. (1894a): Beiträge zur Diplopoden-Fauna Tirols. *Verhandlungen der Zoologisch-botanischen Gesellschaft in Wien*, 44: 9–34.

VERHOEFF, K. W. (1894b): Zur Kenntnis der Copulationsorgane der Juliden, über eine neue Juliden-Gattung und eine neue Tachypodojulus-Art. *Zoologischer Anzeiger*, 17(456): 321–325.

VERHOEFF, K. W. (1895): Beiträge zur Kenntnis paläarktischer Myriopoden. I. Aufsatz: Über einige neue Myriopoden der österreichisch-ungarischen Monarchie. *Verhandlungen der Zoologisch-botanischen Gesellschaft in Wien*, 45: 284–298.

VERHOEFF, K. W. (1897a): Ueber Diplopoden aus Bosnien, Herzogowina und Dalmatien. *Archiv für Naturgeschichte*, 63: 139–156; 181–204.

VERHOEFF, K. W. (1897b): 1. Beiträge zur vergleichenden Morphologie, Gattungs- und Artsystematik der Diplopoden, mit besonderer Berücksichtigung derjenigen Siebenbürgens. *Zoologischer Anzeiger*, 20(528): 97–125.

VERHOEFF, K. W. (1898): Über Diplopoden aus Bosnien, Herzogowina und Dalmatien. IV. Teil: Julidae. *Archiv für Naturgeschichte*, 64: 119–160.

VERHOEFF, K. W. (1899): Beiträge zur Kenntnis paläarktischer Myriopoden. IX. Aufsatz: Zur Systematik, Phylogenie und vergleichenden Morphologie der Juliden und über einige andere Diplopoden. *Archiv für Naturgeschichte*, 65(1): 183–220.

VERHOEFF, K. W. (1900): Wandernde Doppelfüßler, Eisenbahnzüge hemmend. *Zoologischer Anzeiger*, 23(623): 465–473.

VERHOEFF, K. W. (1907): B. Bekannte und unbekannte Diplopoden aus Deutschland und Österreich-Ungarn. *Mitteilungen aus dem Zoologischen Museum in Berlin*, 3: 261–337.

VERHOEFF, K. W. (1908): Über Diplopoden. 10. (30.) Aufsatz: Zur Kenntnis der Juliden und über einige Polydesmiden. *Archiv für Naturgeschichte*, 73(1): 423–474.

VERHOEFF, K. W. (1911): Über Diplopoden. 18. (38.) Aufsatz: Die nordböhmisch-sächsische Fauna und ihre Bedeutung für die Zoogeographie Mitteleuropas. *Sitzungsberichte und Abhandlungen der naturwissenschaftlichen Gesellschaft "ISIS" in Dresden*, 1910(1): 20–66.

VERHOEFF, K. W. (1911): Zur Kenntnis des Mentum der Iuloidea und über Protoiuliden. (Über Diplopoden 49. Aufsatz). *Zoologischer Anzeiger*, 38(24): 531–546.

VOIGTLÄNDER, K. (2011): Preferences of common Central European millipedes for different biotope types (Myriapoda, Diplopoda) in Saxony-Anhalt (Germany). *International Journal of Myriapodology*, 6: 61–83.

WAGA, A. F. (1857): Description d'une nouvelle espèce Européenne de Crustacees (Philoscia notata) et d'un nouveau Myriapode (Gervaisia costata). *Annales de la Société entomologique de France*, 3(5): 827–832.

WANKEL, H. (1861): Beiträge zur österreichischen Grottenfauna. *Sitzungsberichte, Akademie der Wissenschaften in Wien, Mathematisch-Naturwissenschaftliche Klasse, Abteilung I*, 43: 251–264.

WYTWER, J., GOLOVATCH, S. I., PENEV, L. (2009): Variation in Millipede (Diplopoda) assemblages in oak woodlands of the Eastern European Plain. *Soil Organisms*, 81: 791–813.

ZULKA, K. P. (1991): *Überflutung als ökologischer Faktor Verteilung, Phänologie und Anpassung der Diplopoda, Lithobiomorpha und Isopoda in den Flußauen der March.* Dissertation, Universität Wien, pp.65.